Progress Report

Inventory of montane-nesting birds in National Parks of Northwest Alaska: a summary of the 2001 and 2002 field efforts

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INTRODUCTION

The National Park Service administers five large land units in northwest Alaska: Cape Krusenstern National Monument, Noatak National Preserve, Bering Land Bridge National Preserve, Gates of the Arctic National Park and Preserve, and Kobuk Valley National Park. Together they comprise the Arctic Network of Parks and cover almost 81,000 km^2 (20.4 million acres), or 5% of Alaska's land area. The units range in size from the relatively small Cape Krusenstern, at 2,670 km^2 (660,000 acres), to the very large Gates of the Arctic, at almost 34,000 km^2 (8.4 million acres).

The landscape of the region is dramatic and diverse but dominated by hills and mountains that begin along the Chukchi Sea coast and become progressively higher and more rugged farther inland. The easternmost park in the network, Gates of the Arctic, is almost entirely montane with only a small fraction of the land, mostly intermountain valleys, below 600 m (1,950 feet) elevation. The landcover of the uplands in Arctic Network is also quite varied. Lower slopes are covered with open low willow-sedge tundra, sedge-willow, and wet sedge meadow tundra; the higher elevations support montane vegetative communities including dwarf shrub, mountain heath, and *Dryas*-lichen tundras (Viereck et al. 1992). High ridgelines and mountains are often bare or sparsely covered with vegetation.

All five Arctic Network units are estimated to host between 150 and 200 species of birds, but adequate documentation is lacking for 20-40% of these. The poorest documented avifauna is that which occurs in montane habitats, especially in the larger parks. Based on information from relatively small portions of Arctic Network Parks (Gill et al. 1996) and elsewhere in Alaska (Gill et al. 1999, McCaffery and Gill 2001), montane areas in the Arctic Network are likely to provide important nesting habitat for particular assemblages of birds, most notably several medium- to large-sized shorebirds and several montane-nesting passerine species. Recent regional and national shorebird conservation planning efforts (ASWG 2000, Brown et al. 2001) have identified certain shorebird species and habitats as being of high conservation concern, primarily due to documented or perceived population declines and/or restricted distributions. In Alaska, 14 such

species have been identified. Six of them nest in montane regions, including Pacific Golden-Plover, Wandering Tattler, Whimbrel, Bristle-thighed Curlew, Bar-tailed Godwit, and Surfbird (see Table 1 for list of scientific names). At the national level this same suite of species has been ranked similarly high: all were assigned conservation prioritization scores of four on a scale of one to five (Brown et al. 2001).

Despite the obvious importance of the Arctic Network Parks to regional, national, and international populations of montane-nesting birds, particularly shorebirds, information on species distribution and abundance is limited or non-existent for most geographic areas of the parks—the exceptions being Bering Land Bridge National Preserve and coastal portions of Cape Krusenstern National Monument. To address these needs, the Alaska Science Center of the U. S. Geological Survey (USGS) received funding from the National Park Service's Inventory and Monitoring Program to design and implement a study that would determine the status of montane-nesting birds occurring in the Arctic Network of Parks.

This report summarizes results from the 2001 (Gill et al. 2002) and 2002 field efforts. Additional copies are available through the Alaska Science Center.

Goals and Objectives

The goal of this project is to document the occurrence of 90% of the species of montane-breeding birds likely to occur in the Arctic Network of Parks. We have employed a repeatable, scientifically valid sampling design suited to expansive areas with limited access to address three principal objectives:

1. Collect and summarize all existing information on the distribution and abundance of all avian species occurring on upland habitats in Arctic Network Parks.

   Progress: Compilation efforts are ongoing.

2. Obtain geographic data layers needed to characterize elevation, slope, and habitat (vegetation and hydrology), and measures of seasonal green-up.

   Progress: Digital geographic layers depicting elevation, slope, and seasonal green-up were obtained from the National Park Service and USGS. We used ecological unit maps (Jorgenson 2001, Swanson 2001a, b) as the basis for allocating the avian sampling effort across parks and ecoregion types.

3. Determine species-specific associations between distribution, abundance, and habitat characteristics, particularly for species of shorebirds and passerines occurring on upland areas during the breeding season; project this information to obtain park-wide assessments of distribution and abundance.

   Progress: Preliminary findings from the avian sampling effort at Cape Krusenstern National Monument (2001 field season), Kobuk Valley National Park (2002 field season), and in western- and central-Noatak National Preserve (2001 and 2002 field seasons) are presented in this report.

METHODS

Study Area and Access

The study area encompasses all five units of the Arctic Network of Parks (Figure 1). Field work during the study period will focus on all but Bering Land Bridge, where extensive studies of montane-nesting birds were conducted in 1988–1989 and 1999 as part of a separate study but employing methodologies and objectives used in the current effort (Gill et al. unpubl.). During the 2001 field season (Gill et al. 2002), the first of three allocated for the study, we sampled all of the sample plots located in Cape Krusenstern (5 of 5) and a little under half of the plots located in Noatak (15 of 35). In 2002, we sampled all but one of the sample plots located in Kobuk Valley (8 of 9) and sampled 14 of the remaining 20 plots in Noatak. To access sample plots, we used a Hughes 500 helicopter based out of Red Dog Mine in 2001 and a Bell Jet Ranger based

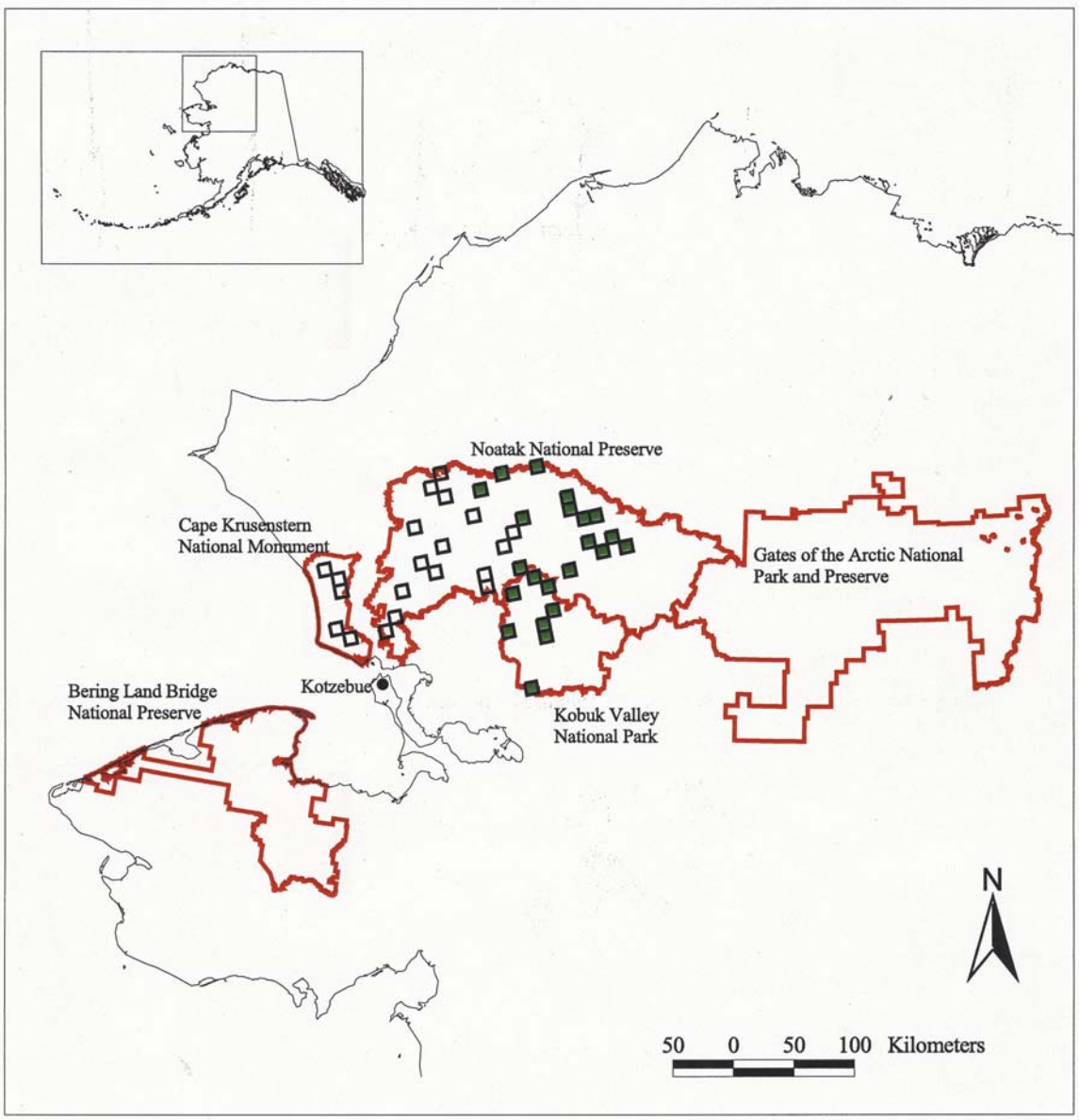

Figure 1. Location of the Arctic Network Parks and all sample plots completed in 2001 (open squares) and 2002 (filled squares).

out of Ambler and Lake Kangilipak in 2002. Straight-line distances between helicopter bases and sample plots ranged between 30 and 125 km in 2001 and 17 and 147 km in 2002.

Sampling Design

We used a stratified random sampling design incorporating increased sampling intensity in areas of special interest to determine sample plots within the four National Park Service units in this study. Stratification was based on ecological unit maps of each park unit that were provided by the National Park Service. These maps delineated ecosystem regions (or ecoregions) based on numerous biotic and abiotic factors (e.g., geology, landforms, soils, vegetation). Ecoregions were mapped at different scales and, for this study, we used the section (1:7,500,000 to 1:3,500,000) and subsection (1:3,500,000 to 1:250,000) mapping scales. Each sampling unit consisted of a 10-km x 10-km plot selected from an Alaska-wide GIS-generated sampling grid of similar sized plots (B. Boyle unpubl.). The grid was aligned with the eastern boundary between Alaska and Canada and offset a random distance in the northward direction (after Overton 1993). Table 2 defines the terms used in the plot selection process.

The sampling universe for each park unit was defined using GIS data layers (digital elevation models, park boundaries, ecoregion boundaries, and sampling grid) and procedures that allowed a plot to be included in the universe if the following conditions were met: 1) at least 50% of the area of the plot was within park boundaries, 2) 25% of the plot was at least 100 m above sea level, and 3) 50% of the plot had <30 degree slope. These criteria resulted in 652 of a possible 863 plots being available for selection. After determining that between 20 and 25 plots could be sampled per year in the two-week period that was determined to be optimal for maximizing detections of birds (Gill et al. unpubl.), we selected 75 sample plots. These plots were allocated among the four park units based on 1) the diversity of habitats within each park, 2) the uniqueness of certain habitats, and 3) the amount of area within each park. Thus Gates of the Arctic received fewer sample plots (n = 26) relative to its size than the other parks because ecological unit mapping suggested it supported relatively fewer habitat types and Cape Krusenstern

received more sample plots (n = 5) than warranted by size because of the diversity and uniqueness of its habitats. The remaining sample plots were allocated to Noatak (n = 35) and Kobuk Valley (n = 9) based on the relative size of these parks.

Once we resolved the number of sample plots to be allocated to each park unit we determined how to allocate plot locations within each park unit. We first calculated the area (ha) of each subsection within each 10-km x 10-km plot and labeled plots based on their most abundant subsection type. Such labels allowed us to allocate sample plots proportionally to subsection occurrence. We next allocated samples by stratifying by sections for Gates of the Arctic, Kobuk Valley, and Noatak and by subsections for Cape Krusenstern. Samples were allocated usually in proportion to the size of the strata, except that sections that were slightly smaller but unique in terms of habitat or geographic location were allocated a single plot. Once we determined how many plots would fall in each section, we then looked at the amount of area that fell into distinct subsection groups within each of the sections. Groups were based on topographical features (i.e., mountains, hills, foothills, uplands, glaciated uplands, basin). We then subdivided the plots roughly in proportion to the area covered by those groups of subsections. To get good geographic coverage across the park, we then ordered the subsections within each group roughly from west to east and looked at the amount of area within them. Since the number of plots to be selected was usually less than the number of subsections available, we set up groups of subsections from which plots could be randomly selected, with the numbers of plots roughly proportional to the combined area.

After plots were selected we produced plot maps depicting the coverage and configuration of subsections within each plot so that sample points could be spread across subsection types in proportion to their area within the plot. Figure 2 demonstrates how the process of point allocation within a sample plot is interpreted in the field.

Point Count Surveys

Birds were sampled with variable circular plot methodology (Buckland et al. 2001) using protocols developed by the USGS Shorebird Project. We used nine (2001) and eight

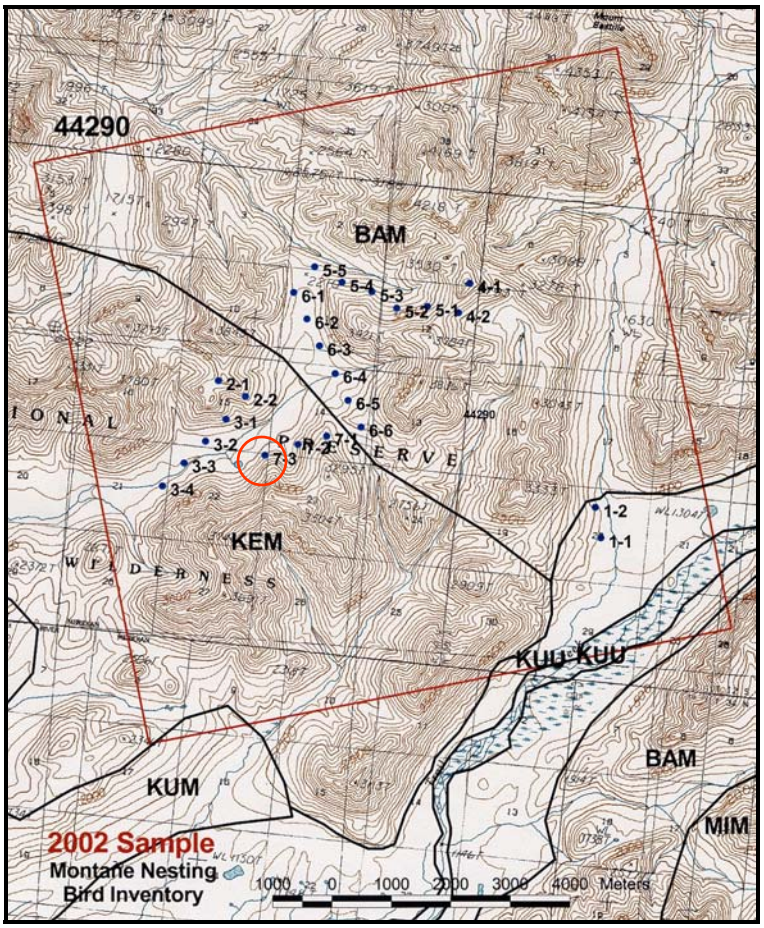

Figure 2. A typical example of point count allocation within a study plot. A total of 24 points was allocated in proportion to the total area of each subsection type (see Table 2) in plot 44290, Noatak National Preserve. Thus, 2 point counts were conducted in KUU, 9 in KEM, and 13 in BAM. The photo, facing northwest, was taken in subsection KEM during the survey at transect 7, point 3, on 4 June 2002. Location on map circled in red.

(2002) observers distributed in various two-person field crews to survey the sample plots. One member of each crew had experience (3–8 field seasons) conducting point counts of birds using similar methodologies to the one described here and all had several years of field experience studying the avifauna of Alaska.

At each sample plot, we conducted a total of 24 unlimited distance point counts. Previous studies of similar bird species in similar habitats (Gill et al. unpubl.) demonstrated that 24 points was the minimum number of points necessary to detect 90% of the breeding species likely to occur on a given plot. To minimize the probability of detecting the same individual bird at multiple points, we spaced points along transects at 500-m intervals and spaced legs of transects within the same subsection type at least one drainage apart. Prior to going into the field, crews used 1:63,360-scale maps to determine routes of potential transects, assuring that the routes crossed gradients of elevation and landcover and that the required number of points was placed in each subsection. Routes were modified in the field when it became apparent that certain creeks or landforms could not be traversed safely.

At each point on a transect we conducted two counts: 1) a 10-min count during which we collected detailed information on shorebirds and shorebird predators and kept a tally of all other avian species, and 2) a subsequent 5-min count at the same point during which we collected detailed information on all other bird species: passerines, waterbirds, ptarmigan, etc. In addition, when traveling between points we recorded all bird species that had not yet been observed at previous sampling points. We also maintained a comprehensive bird list for the 1.5–2 days we were present at each plot.

At the start of each 10-min count, we recorded the following: GPS location and positional error, date, time of day, observers, elevation (using altimeter), slope, aspect, estimated wind speed, wind direction, precipitation, percent cloud cover, air temperature, percent snow cover, and percent cover of all vegetation types within 150 m of the point. We classified vegetation to at least level III of the Viereck et al. (1992) system, further classifying to level IV when possible. Observers used laser rangefinders when necessary

to determine the 150-m radius around a point and then visually estimated percent cover of the different vegetation types within the circle. Under most field conditions the measurement accuracy of the rangefinders was ± 2 m (Bushnell website).

For each detection of a shorebird or shorebird predator during the 10-min count and all other bird species during the 5-min count, we recorded the following: elapsed time, species, number of individuals, and radial distance from the census point. When possible, we collected additional data such as behavior, vocalizations, breeding status, and microhabitat with which the bird was associated. We used rangefinders to estimate radial distance to individual birds. If an individual was heard but not seen, we recorded the possible range of its location (e.g. 70–120 m, 300–400 m) by estimating (using rangefinders when possible) the distance to landmarks on either side of the calling bird. For birds at extreme distances (too far for the rangefinder) we recorded the possible range of their locations using topographic features referenced on 1:63,360 maps.

Data Management and Analysis

We downloaded geographic location data from Garmin 12 and Etrex GPS units. All field data were entered into an Excel spreadsheet and the 2001 data were transferred to a Microsoft Access database designed by the National Park Service; 2002 data are currently being transferred to the same database.

During winter 2002/spring 2003 we will 1) continue developing metadata materials that will comply with Federal Geographic Data Committee's (FGDC) standards for digital geospatial metadata (www.fgdc.gov/metadata/contstan.html) and be compatible with the biological databases maintained by the Inventory and Monitoring Program of the National Park Service, and 2) construct maps for each species depicting (a) presence/absence data at the level of sample points and plots and (b) predicted distributions within each park unit.

Results presented herein are summarized by park. Thus, data presented for Noatak are composed of surveys conducted in both 2001 (western Noatak) and 2002 (central

Noatak). All Cape Krusenstern data were collected in 2001, while all Kobuk Valley data were collected in 2002.

RESULTS

Survey Conditions and effort

The chronology of spring breakup was similar between years, but slightly ahead of normal over inland areas of Cape Krusenstern, Kobuk Valley, and Noatak. Daily minimum temperatures remained above freezing after 31 May in both years. Mean daily minimum and maximum temperatures of 36.4°F ± 3.59 SD (range 32–43) and 59.2°F ± 6.05 (range 51–69), respectively, were recorded at the village of Noatak during the 2001 survey period while mean daily minimum and maximum temperatures of 40.7ºF ±8.76 SD (range 28–55) and 60.3ºF ±7.72 SD (range 46–72), respectively, were recorded at the village of Ambler during the 2002 survey period (http://fire.ak.blm.gov). Snow cover during the sample periods decreased from about 15–25% on most plots in early June to less than <5% by the end of the surveys in both years.

Surveys were conducted from 1–11 June, 2001 and 30 May–9 June, 2002. We sampled a total of 20 plots in 2001 (5 in Cape Krusenstern and 15 in Noatak) and 22 plots in 2002 (8 in Kobuk Valley and 14 in Noatak). Appendices 1 and 2 depict locations of sample plots in 2001 and 2002, respectively. In 2001, we sampled 472 points, totaling about 79 h of actual survey time for shorebirds and associated predators (10-minute counts) and 39 h for other bird species (5-minute counts). In 2002, we sampled a total of 533 points, totaling approximately 89 h for shorebirds and associated predators and 44 h for other birds.

Species richness and distribution

We detected a total of 100 species of birds on the sample plots, including 53 in Cape Krusenstern, 54 in Kobuk Valley, and 87 in Noatak (Table 1). Overall there were 23 species of shorebirds; 13 species of potential predators of shorebird adults, eggs, or

young, including 8 raptors, 3 jaegers, and 2 corvids; 35 species of passerines; 22 species of waterfowl; 2 species of gulls, 2 species of ptarmigan, 1 species of grouse, 1 species of tern, and 1 species of crane. In Cape Krusenstern, the Buff-breasted Sandpiper was the only shorebird species and Hoary Redpoll the only passerine species detected by us that had previously been undocumented but expected to occur in the park (National Park Service Expected Species Lists 2000). In Kobuk Valley, we recorded five species that had not previously been documented as occurring in the park: Common Merganser, Parasitic Jaeger, Horned Lark, Bluethroat, and Gray-crowned Rosy-Finch. In Noatak, we recorded eight species on the National Park Service list of Expected Species that had not previously been documented as occurring in the park: Bufflehead, Common Merganser, Red-tailed Hawk, Hudsonian Godwit, Surfbird, Red Knot, Pomarine Jaeger, and Hermit Thrush. We also recorded Pacific Golden-Plover as present, a species not expected to occur in Noatak (National Park Service Expected Species Lists 2000).

On average we detected 30.4 ± 2.2 SD species on Cape Krusenstern plots, 25.0 ± 3.5 SD species on Kobuk Valley plots, and 26.0 ± 5.4 SD species on Noatak plots during and between surveys (Table 3). These included several species that do not breed in montane habitats and that we suspect were migrating through the region to more northern or eastern breeding areas or to lower-elevation breeding habitats (e.g., Brant, Sandhill Crane, Bank Swallow). A more direct comparison of the diversity of montane-breeding species on the plots can be made using the number of species recorded just during 10-min counts (site diversity). According to this index, diversity per plot ranged from 11–29 species with averages similar among parks (Table 3).

To examine variability in the distribution of birds, we first calculated the average number of species recorded per point within each plot (average point diversity). We then calculated an index of spatial homogeneity for each plot by calculating the average proportion of species recorded in the plot that were recorded at each point (i.e., average point diversity/site diversity). Point diversity ranged from 1.1 to 8.0 species per point and was generally higher on Cape Krusenstern plots (Table 3). Spatial homogeneity was

also higher at Cape Krusenstern (0.27) than at Kobuk Valley (0.19) or Noatak (0.17), suggesting that species were distributed more evenly at Cape Krusenstern.

Eighty-two species (82%) were detected during at least one point count (either a 5- or 10-min-long count). Nine others (9%) were detected only between points, and only seven species (7%) were detected when not conducting counts (Tables 4–6). The latter two types of detections mostly involved species that did not breed in montane habitats (e.g., Dunlin, Tree Swallow).

Among shorebirds, only two species (Wilson's Snipe [formerly Common Snipe] and American Golden-Plover) were widely distributed (detected on ≥ 75% of plots) and three species (Whimbrel, Wandering Tattler, and Surfbird) were moderately widespread (detected on 25% – 75% of plots) (Table 4). The remaining 18 species had more restricted distributions and were detected on ≤ 25% of plots, including six that occurred on only one plot each. Among potential shorebird predators, only two species (Common Raven and Long-tailed Jaeger) were widespread, while another five species were moderately widespread, and six species had restricted distributions.

Compared to shorebirds, a greater proportion of passerine species (19% vs. 9%) was widely distributed (Redpoll sp., Savannah Sparrow, American Tree Sparrow, White-crowned Sparrow, American Pipit, Horned Lark, American Robin; Table 5). Most species were either moderately widespread (n = 11; e.g. Lapland Longspur, Gray-cheeked Thrush, Golden-crowned Sparrow) or had restricted distributions (n = 22; e.g. Yellow Wagtail, Gray-crowned Rosy-Finch, Varied Thrush). Species of waterfowl, gulls, terns, and cranes occurred sporadically with no species detected on more than 18 plots (Table 6). Rock and Willow ptarmigan were moderately widespread, occurring on 30 and 26 plots, respectively (Table 6).

FREQUENCY OF OCCURRENCE

We recorded 555 detections (676 individuals) of shorebirds and potential shorebird predators on the Cape Krusenstern plots, 92 detections (81 individuals) on the Kobuk

Valley plots, and 763 detections (726 individuals) on the Noatak plots (Table 7). Shorebirds and potential shorebird predators were detected much more often in Cape Krusenstern, occurring on 93% of 10-min counts (n = 120), compared to both Kobuk Valley and Noatak where they were recorded on only 35% (69 of 197) and 53% (361 of 688) of all such counts, respectively. For species surveyed during 5-min counts, we recorded 536 detections (638 individuals) on Cape Krusenstern plots, 686 detections (695 individuals) on Kobuk Valley plots, and 2,129 detections (2,338 individuals) on Noatak plots (Table 8). Unlike with shorebirds and potential predators, birds surveyed during 5-min counts were detected at similar, high rates across parks: 96% of counts at Cape Krusenstern, 92% at Kobuk Valley, and 85% at Noatak.

Most birds were detected within the first few minutes of a count; 66% of all detections on 10-min counts occurred during the first 5 min and 74% of all detections on 5-min counts occurred during the first 3 min. The majority of detections involved single birds on both 10-min (87%) and 5-min (94%) counts.

The five most commonly detected shorebirds and their potential predators were the same at Cape Krusenstern and Noatak (Whimbrel, Wilson's Snipe, American Golden-Plover, Long-tailed Jaeger, and Common Raven), although not in exactly the same order (Table 7). This was similar to Kobuk Valley plots where the five most commonly detected shorebirds and potential predators included Surfbird and Mew Gull in addition to Wilson's Snipe, American Golden-Plover, and Common Raven. These species accounted for 83%, 75%, and 72% of all detections on 10-min counts at Cape Krusenstern, Kobuk Valley, and Noatak, respectively. Differences in species composition of shorebirds between the parks were revealed in the occurrence patterns of the less common species. Bar-tailed Godwits were regular on Cape Krusenstern counts (0.308 individuals/point) but not present on either Kobuk Valley or Noatak counts. Similarly, Wandering Tattler and Surfbird occurred occasionally on Kobuk Valley and Noatak counts but not at all on Cape Krusenstern counts. The three most commonly detected passerines were Lapland Longspur, Savannah Sparrow, and American Tree Sparrow at Cape Krusenstern; Golden-crowned Sparrow, American Robin, and Fox

Sparrow at Kobuk Valley; and Savannah Sparrow, American Tree Sparrow, and Redpoll sp. at Noatak (Table 8). These species accounted for 69%, 36%, and 47% of all passerine detections on 5-min counts at Cape Krusenstern, Kobuk Valley, and Noatak, respectively. Ptarmigan were encountered more frequently at Cape Krusenstern than at either Kobuk Valley or Noatak (Table 8).

DETECTION BY TYPE AND DISTANCE

Over half (61%) of all detections of shorebirds and their potential predators during10-min counts were visual. Fewer (41%) of the bird detections during 5-min counts were visual, as singing male passerines were often obscured by vegetation. Observers were able to measure exact distances (using range finders) to visually-located birds on 10-min and 5-min counts 59% and 78% of the time, respectively. Observers were also able to measure distances to a small percentage of the 'heard-only' birds by associating them with a prominent land feature (rock outcropping, solitary bush in meadow, etc.). Measured distances to 'heard-only' birds were assessed for 10% of shorebirds and/or shorebird predators and 13% of birds detected on 5-min counts. For all other detections, we estimated distances using intervals (e.g., 50–75 m, 200–275 m). The breadth of the estimated distance interval usually increased with a bird's distance from the point unless we could easily delineate the area they were located in or were singing from (e.g., between a creek and a prominent patch of vegetation).

Our ability to determine distance of a bird from a point was influenced by many factors. Not surprisingly, the behavior, size, and plumage characteristics of certain species made it easier for us to visually locate them. We measured distance for a high proportion of situations in which birds in bright plumage occupied open habitats (e.g., American Golden-Plover, Rock Ptarmigan) and estimated distance (i.e., used intervals) for a high proportion of situations in which small- to medium- sized birds vocalized in closed habitats (e.g., Fox Sparrow, Gray-cheeked Thrush, Wilson's Snipe).

HABITAT ASSOCIATIONS BY SPECIES

Observers were able to directly associate a bird with a vegetation class for 27% of the detections of shorebirds and their potential predators. Among these, 52% of bird detections were associated with mesic graminoid herbaceous vegetation (MGH) and 13% with *Dryas* dwarf scrub vegetation (DDS). The remaining birds were associated with 20 other vegetation classes or combinations of classes. Habitat associations also varied by species. For example, Whimbrels were almost always associated with MGH (76%) whereas American Golden-Plovers were usually found among various classes, including MGH (38%), DDS (26%), and dry forb herbaceous (DFH) vegetation (12%).

Observers assessed vegetation associations for about a third (31%) of birds detected during 5-min counts. Within this sub-sample, 23% of birds were associated with MGH, 18% with closed tall shrub (CTS), 17% with open low shrub (OLS), and 15% with closed low shrub (CLS) classes. The remaining individuals used 21 other classes or combinations of classes. Habitat associations varied by species and were based on life history requirements. For example, 65% of the shrub-nesting American Tree Sparrow detections were in either CTS or CLS habitats, while 79% of ground-nesting Lapland Longspur detections occurred in open MGH habitats.

BEHAVIOR AND BREEDING STATUS

We classified the behavior of 79% (n = 1,423 detections) of the shorebirds and potential shorebird predators recorded. Based on this sub-sample, behavior of most shorebirds was characterized as courtship/breeding display (47%), standing/preening/sleeping (26%), or flying/walking (14%). For potential predators, most detections were of individuals flying or walking (68%) or standing/preening/sleeping (24%). We were likewise able to determine the behavior for a high proportion of passerines (90% of 2,916 detections) because we could infer their behavior from vocalizations, i.e., singing males were considered to be engaging in courtship/breeding activities. With that assumption, most passerines were performing courtship or breeding displays (81%), or flying/walking (14%). Very few passerines were seen feeding (1%) or engaged in maintenance (3%) or

agonistic (1%) behaviors. Waterfowl were typically seen as pairs or groups on water bodies (24%) or flying (45%) over plots. Most detections of gulls (64%) were of birds flying low along creeks or rivers and most detections of ptarmigans (54%) were of males standing on prominent shrubs or rock outcroppings.

Based on behavior and plumage characteristics of the shorebirds we observed, we could classify 38% as males (362 individuals) and 5% as females (47 individuals); 57% (539 individuals) could not be sexed. On the other hand, among 3,021 passerines detected, 75% could be classified as male and 1% as female; sex could not be assigned to 24%. Since our surveys were timed to coincide with early nesting and females of most species are generally more secretive than males, the much higher detection probability we recorded for males of both groups is expected.

Lastly, a fundamental constraint of this methodology is that counts occur during early nesting when the detectability of birds, through vocalization and/or display, is greatest. Sample plots in Cape Krusenstern were surveyed within this window, but could have been initiated 2–4 days earlier to assure optimal detections. By the end of the survey period it was not uncommon to find several species of shorebirds incubating complete clutches of eggs. In Kobuk Valley and Noatak, phenological conditions are slightly delayed compared to the more coastal Cape Krusenstern plots. Detection of birds at Noatak plots was probably optimal in 2001 based on observations of nest-scraping and territorial displays that were still quite common at the end of the survey period. In 2002, timing was slightly later, as many male passerines quieted noticeably towards the end of the survey period. In both years, it was not uncommon to find birds incubating complete clutches of eggs towards the end of the survey period. Logistical constraints and multi-scale differences in local spring phenology make it difficult to optimize survey conditions at all plots in a given year, but by focusing our work in a short period before and during the early nesting period we were able to minimize differences in detection probabilities among plots.

ONGOING DATA SUMMARIZATION AND ANALYSIS

For those species with > 50 individual detections, we are using the program DISTANCE (Buckland et al. 2001) to model detection probabilities and to estimate densities (with 90% confidence intervals) across habitats, ecoregions, and parks. The distance data gathered in 2001 and 2002 are sufficient to estimate the density for 3 species of shorebirds, 2 predators, 11 passerines, 2 ptarmigan, and 1 waterfowl. Our ability to estimate density for other species will increase as we add to this data set over the next field season.

We will use logistic regression to estimate the probability of detecting a species at any location in the study area. To do so, we will construct a resource selection probability function (Manly et al. 1993) by comparing characteristics of the sample points that are used or unused by each species. The presence or absence of the species will be the dependent variable and habitat and topographic characteristics (e.g., elevation, slope) around the point will be used as explanatory variables. Because points were selected in a systematic random fashion, we can assume that the sampling fractions of used and unused points are equal and we can estimate the probability that a particular point in the park will be used by a given species. For those variables for which information is available on park-wide GIS, we will develop resource selection probability functions by comparing points used by each species with a randomly selected sample of points available in the study area. Habitat composition at the points is currently being summarized. From the 2001 effort we learned that accurate measures of elevation and slope were difficult to obtain in the field. Thus, these parameters for each point will be extracted from a GIS projection by overlaying sample points on digital elevation models.

PLANNING FOR 2003

Training

- ✓ Arrange training sessions on GPS navigation and orienteering.
- ✓ Ensure that all field workers know how to compute latitude and longitude of their position from 1:63,360 USGS maps.
- ✓ Require that all participants attend distance-estimation training.

- ✓ Require that all participants, regardless of experience, receive training in identification of bird vocalizations and behaviors.
- ✓ Prior to fieldwork, quiz observers on how to fill out data forms under different scenarios.
- ✓ Conduct sample transects around Anchorage/Hatcher Pass in order to ensure that all observers collect data in a standardized, unambiguous fashion. Make sure everyone participates and becomes familiar with the mistakes that are commonly made during data collection.

Survey schedules and route determination

- ✓ Spend sufficient time prior to fieldwork examining maps and aerial images and choosing potential routes, campsites, etc. This will help minimize time spent between points and between transects and facilitate helicopter scheduling.
- ✓ Generate a grid of known locations for each plot to facilitate route placement and navigation in the field.

Data collection

- ✓ Make sure crews fill out and review all forms prior to leaving a plot (preferably after each point), including their summary of the status of all species detected (e.g., nesting robins, displaying pipits, flocking ptarmigan).

Survey timing

- ✓ Examine remote imagery depicting greenup and snowmelt to adjust scheduling if markedly different from the norm.
- ✓ If budget permits, consider revisiting a sub-sample of plots in late June to search for any late-arriving species.

Personnel and survey schedules

- ✓ Require that helicopter pilot has sufficient backcountry experience to be able to work with or without a GPS.

- ✓ Ensure that each two-person crew receives a hand-held satellite phone unit and spare batteries in order to allow for daily logistics planning and safety checks.

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LITERATURE CITED

Alaska Shorebird Working Group. 2000. A Conservation Plan for Alaska Shorebirds. Unpubl. Rep., Alaska Shorebird Working Group. Available through U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska. 47 pp.

Brown, S., C. Hickey, B. Harrington, and R. Gill, eds. 2001. The U.S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling. Oxford University Press, New York.

Gill, R. E., Jr., M. T. Schroeder, and J. M. Schnorr. 1996. An assessment of the breeding status of Bristle-thighed Curlew (*Numenius tahitiensis*) and other montane-nesting shorebirds within Cape Krusenstern National Monument, Alaska, 23–27 May and 8–11 July 1996. Unpubl. Rpt., National Biological Service, Anchorage, AK.

Gill, R. E., Jr., P. S. Tomkovich, and M. N. Dementyev. 1999. Breeding ecology of Surfbirds (*Aphriza virgata*) at Turquoise Lake, Alaska, 1997–1998 (with observations of nesting Wandering Tattlers *Heteroscelus incanus* and annotated notes on birds and mammals). Unpubl. Rpt., USGS, Alaska Biological Science Center, Anchorage, AK.

Gill, R. E., Jr., T. L. Tibbitts, C. M. Handel, and D. L. Brann. 2002. Inventory of montane-nesting birds in National Parks of Northwest Alaska: the spring 2001 field effort. Unpubl. Rpt., USGS, Alaska Biological Science Center, Anchorage, AK.

Jorgenson, T., K. Boggs, and J. Michaelson. 2001. Ecological subsections of Gates of the Arctic National Park and Preserve. Unpubl. Rept., ABR Inc., for National Park Service, Fairbanks, AK.

Jorgenson, T., D. Swanson, and M. Macander. 2002. Ecological subsections of Noatak National Preserve. Unpubl. Rept., ABR Inc., for National Park Service, Fairbanks, AK.

Manly, B., L. McDonald, and D. Thomas. 1993. Resource selection by animals. Chapman and Hall, New York.

McCaffery, B. J., and R. E. Gill, Jr. 2001. Bar-tailed Godwit (*Limosa lapponica*). *In* The Birds of North America, No. 581 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Overton, W. S. 1993. Probability sampling and population inference in monitoring programs. Pp. 470-483 *in* Environmental modeling with GIS (M. F. Goodchild, B. O. Parks, and L. T. Steyaert, eds.). Oxford University Press, New York.

Swanson, D. K. 2001a. Ecological units of Kobuk Valley National Park, Alaska. Unpubl. Rpt., National Park Service, Fairbanks, AK 99701.

Swanson, D. K. 2001b. Ecological units of Cape Krusenstern National Monument, Alaska. Unpubl. Rpt., National Park Service, Fairbanks, AK 99701.

Viereck, L. A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. U.S.D.A. Forest Serv., Pacific Northwest Research Station, Portland, OR. 278 pp.

Table 1. Birds recorded on Cape Krusenstern National Monument, Kobuk Valley National Park, and Noatak National Preserve during spring 2001 and 2002.

Common name[1]	Scientific name	Present[2]		
		Cape Krusenstern	KobukValley	Noatak
Red-throated Loon	*Gavia stellata*			x
Pacific Loon	*G. pacifica*			x
Common Loon	*G. immer*			x
Yellow-billed Loon	*G. adamsii*	o		
Greater White-fronted Goose	*Anser albifrons*	o		b
Snow Goose	*Chen caerulescens*	o		
Canada Goose	*Branta canadensis*	o		b
Brant	*B. bernicla*			o
Tundra Swan	*Cygnus columbianus*	o		b
Mallard	*Anas platyrhynchos*	o		o
Northern Pintail	*A. acuta*	o		b
American Wigeon	*A. americana*			x
Northern Shoveler	*A. clypeata*			x
Green-winged Teal	*A. crecca*			b
Greater Scaup	*A. marila*			b
Black Scoter	*Melanitta nigra*			x
Surf Scoter	*M. perspicillata*			x
White-winged Scoter	*M. fusca*			x
Long-tailed Duck	*Clangula hyemalis*			b
Bufflehead	*Bucephala albeola*			**o**
Common Merganser	*Mergus merganser*		**x**	**b**
Red-breasted Merganser	*M. serrator*			x
Northern Harrier	*Circus cyaneus*	o	x	b
Red-tailed Hawk	*Buteo jamaicensis*			**x**
Rough-legged Hawk	*B. lagopus*	o	x	b
Golden Eagle	*Aquila chrysaetos*	o	x	b
Merlin	*Falco columbarius*	o	x	b
Gyrfalcon	*F. rusticolus*	o	x	b
Peregrine Falcon	*F. peregrinus*	o	x	
Spruce Grouse	*Falcipennis canadensis*		x	
Willow Ptarmigan	*Lagopus lagopus*	o	x	b
Rock Ptarmigan	*L. mutus*	o	x	b
Sandhill Crane	*Grus canadensis*	o		o
American Golden-Plover	*Pluvialis dominica*	o	x	b
Pacific Golden-Plover	*P. fulva*			**o**
Semipalmated Plover	*Charadrius semipalmatus*	o		b
Greater Yellowlegs	*Tringa melanoleuca*			o
Lesser Yellowlegs	*T. flavipes*			b
Wandering Tattler	*Heteroscelus incanus*	o	x	b
Spotted Sandpiper	*Actitis macularia*		x	
Upland Sandpiper	*Bartramia longicauda*			o
Whimbrel	*Numenius phaeopus*	o		b

Table 1. Continued.

Common name[1]	Scientific name	Present[2]		
		Cape Krusenstern	KobukValley	Noatak
Hudsonian Godwit	*Limosa haemastica*			**o**
Bar-tailed Godwit	*L. lapponica*	o		x
Surfbird	*Aphriza virgata*		x	**b**
Red Knot	*Calidris canutus*			**o**
Semipalmated Sandpiper	*C. pusilla*	o		b
Western Sandpiper	*C. mauri*	o		
Least Sandpiper	*C. minutilla*			b
Baird's Sandpiper	*C. bairdii*	o	x	b
Pectoral Sandpiper	*C. melanotos*	o		
Dunlin	*C. alpina*	o		
Buff-breasted Sandpiper	*Tryngites subruficollis*	**o**		
Long-billed Dowitcher	*Limnodromous scolopaceus*			o
Wilson's Snipe	*Gallinago delicata*		x	b
Red-necked Phalarope	*Phalaropus lobatus*			b
Pomarine Jaeger	*Stercorarius pomarinus*			**o**
Parasitic Jaeger	*S. parasiticus*	o	**x**	b
Long-tailed Jaeger	*S. longicaudus*	o	x	b
Mew Gull	*Larus canus*	o	x	b
Glaucous Gull	*L. hyperboreus*	o	x	b
Arctic Tern	*Sterna paradisaea*	o	x	b
Short-eared Owl	*Asio flammeus*	o		o
Northern Flicker	*Colaptes auratus*		x	
Say's Phoebe	*Sayornis saya*	o	x	b
Northern Shrike	*Lanius excubitor*			x
Gray Jay	*Perisoreus canadensis*		x	o
Common Raven	*Corvus corax*	o	x	b
Horned Lark	*Eremophila alpestris*	o	**x**	b
Tree Swallow	*Tachycineta bicolor*			o
Bank Swallow	*Riparia riparia*		x	b
Boreal Chickadee	*Poecile hudsonicus*		x	o
Ruby-crowned Kinglet	*Regulus calendula*		x	o
Arctic Warbler	*Phylloscopus borealis*			o
Bluethroat	*Luscinia svecica*	o	**x**	b
Northern Wheatear	*Oenanthe oenanthe*	o	x	b
Swainson's Thrush	*Catharus ustulatus*		x	
Gray-cheeked Thrush	*C. minimus*	o	x	b
Hermit Thrush	*C. guttatus*			**o**
American Robin	*Turdus migratorius*		x	b
Varied Thrush	*Ixoreus naevius*		x	o
Yellow Wagtail	*Motacilla flava*	o	x	b
American Pipit	*Anthus rubescens*	o	x	b
Orange-crowned Warbler	*Vermivora celata*	o	x	b
Yellow Warbler	*Dendroica petechia*		x	b
Yellow-rumped Warbler	*D. coronata*		x	o
Wilson's Warbler	*Wilsonia pusilla*	o	x	b

Table 1. Continued.

Common name[1]	Scientific name	Present[2]		
		Cape Krusenstern	KobukValley	Noatak
American Tree Sparrow	*Spizella arborea*	o	x	b
Savannah Sparrow	*Passerculus sandwichensis*	o	x	b
Fox Sparrow	*Passerella iliaca*	o	x	b
White-crowned Sparrow	*Zonotrichia leucophrys*	o	x	b
Golden-crowned Sparrow	*Z. atricapilla*		x	b
Dark-eyed Junco	*Junco hyemalis*		x	o
Lapland Longspur	*Calcarius lapponicus*	o	x	b
Snow Bunting	*Plectrophenax nivalis*	o	x	b
Rusty Blackbird	*Euphagus carolinus*		x	
Pine Grosbeak	*Pinicola enucleator*		x	
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	o	**x**	b
Common Redpoll	*Carduelis flammea*	o	x	b
Hoary Redpoll	*C. hornemanni*	**o**	x	b
Totals		53	54	87

[1]Boldface indicates first confirmation of this species for a park.
[2]o = seen in 2001 only; x = seen in 2002 only; b = seen in both 2001 and 2002.

Table 2. Definitions of terms used in report.

Term	Definition
Section	Physiographic regions with similar geology and regional climate (Jorgenson et al. 2002). Sections are composed of subsections.
Subsection	Portion of a section with a more narrowly defined geology composed of repeated associations of geomorphic units (Jorgenson et al. 2002).
Subsection group	A collection of subsections that share topographic features (i.e., mountains, hills, foothills, uplands, glaciated uplands, and basins). Plots were selected from subsection groups.
Plot	10-km x 10-km sampling unit

Table 3. Plot identification number, dominant subsection type, number of points sampled, and patterns of avian diversity (species richness) on study blocks at Cape Krusenstern National Monument (CAKR), Kobuk Valley National Park (KOVA), and Noatak National Preserve (NOAT), 2001 and 2002.

Park	Block	Subsection[1]	Number of points/block	Overall site diversity[2]	Site diversity[3]	Average point diversity[4]	Spatial homogeneity[5]
NOAT	41890	SQM	24	31	24	4.4	0.18
	42130	ELH	22	29	22	3.2	0.15
	42377	NAM	24	23	22	4.7	0.21
	42384	NTH	24	21	17	2.5	0.15
	42609	ELM	24	23	18	5.0	0.28
	42616	AKH	20	21	18	3.0	0.17
	42619	AKH	24	25	22	3.6	0.16
	42626	UNB	24	27	19	3.1	0.16
	42628	UNB	24	31	29	5.3	0.18
	42851	TUM	24	28	22	3.8	0.17
	42864	IGU	24	29	26	3.9	0.15
	42866	UNB	24	27	25	5.1	0.21
	43089	KIM	24	32	21	2.7	0.13
	43096	KLU	24	27	24	4.0	0.17
	43330	MNU	21	33	21	3.7	0.18
	43336	KLM	21	23	17	3.9	0.23
	43342	AGH	24	21	15	3.4	0.23
	43343	AGU	24	16	14	2.0	0.15
	43576	NIH	24	33	26	3.3	0.13
	43580	ANU	24	23	18	2.5	0.14
	43806	KEU	24	35	24	3.5	0.15
	43811	MIM	26	31	25	3.5	0.14
	43819	ANU	24	30	23	4.1	0.18
	44287	KUM	24	26	22	5.2	0.24
	44290	BAM	24	16	13	1.5	0.12
	44525	KEM	24	29	23	5.0	0.22
	44531	NUM	24	22	15	1.8	0.12
	44534	ANM	24	14	11	1.1	0.10
	44765	KEM	26	27	21	2.7	0.13
	Avg.			26.0	20.6	3.5	0.17

Table 3. Continued.

Park	Block	Subsection[1]	Number of points/block	Overall site diversity[2]	Site diversity[3]	Average point diversity[4]	Spatial homogeneity[5]
CAKR	41887	IHT	24	32	24	4.4	0.18
	42125	IHT	24	32	20	5.6	0.28
	42843	MLH	24	28	21	6.1	0.29
	43082	MLH	24	32	22	8.0	0.36
	43320	WUL	24	28	23	5.4	0.23
	Avg.			30.4	22.0	5.9	0.27
KOVA	40228	WRM	24	19	14	3.8	0.27
	41186	AFH	24	26	20	3.2	0.16
	41422	KLH	25	30	24	4.0	0.17
	41425	AKM	24	22	14	2.8	0.20
	41665	AKM	28	27	23	5.6	0.25
	42140	TUM	24	26	21	3.6	0.17
	42143	AYM	24	27	21	2.9	0.14
	42381	SRH	24	23	19	2.7	0.14
	Avg.			25.0	19.5	3.6	0.19

[1]Subsection types: AFH = Akiak Foothills, AGH = Avingyak Hills, AGU = Avingyak Glaciated Uplands, AKH = Aklumayuak Foothills, AKM = Akiak Mountains, ANM = Anisak Mountains, ANU = Anisak Uplands, AYM = Angayukaqsraq Mountains, BAM = Bastille Mountains, ELH = Eli Foothills, ELM = Eli Mountains, IGU = Iggiruk Glaciated Uplands, IHT = Igichuk Hills, KEM = Kelly Mountains, KEU = Kelly Uplands, KIM = Kikmiksot Mountains, KLH = Kallarichuk Hills, KLM = Kaluktavik Mountains, KLU = Kaluktavik Uplands, KUM = Kugururok Mountains, MIM = Misheguk Mountains, MLH = Mulgrave Hills, MNU = Middle Noatak Uplands, NAM = Nakolik Mountains, NIH = Nimiuktuk Hills, NTH = Natmotirak Foothills, NUM = Nuka Mountains, SQM = Squirrel Mountains, SRH = Salmon River Hills, TUM = Tututalak Mountains, UNB = Upper Noatak Basin, WRM = Waring Mountains, WUL = Wulik Lowland.

[2]Total number of species encountered during 2-day site visit.

[3]Total number of species encountered during 10-min counts.

[4]Average number of species/10-min count.

[5]Average point diversity/site diversity (average proportion of species recorded in block observed at each point). A value of 1 = all species seen on all points.

Table 4. Number of plots (n = 20 in 2001, n = 22 in 2002) on which shorebirds and potential predators of shorebirds, eggs, or young were detected[1] on the the Arctic Network surveys.

	Number of the plots where species:					
Group/species	Detected during 10-min count	Detected during 5-min count	Tallied during 10-min count	Detected between points only	Detected off transect only	Detected
Shorebirds						
Wilson's Snipe	32	NA[2]	NA		2	34
American Golden-Plover	29	NA	NA	1	3	33
Whimbrel	22	NA	NA	1	1	24
Wandering Tattler	11	NA	NA	2	4	17
Surfbird	8	NA	NA		3	11
Baird's Sandpiper	7	NA	NA	1	2	10
Bar-tailed Godwit	5	NA	NA		1	6
Semipalmated Plover	3	NA	NA	2		5
Red-necked Phalarope	1	NA	NA	3		4
Semipalmated Sandpiper	3	NA	NA			3
Pectoral Sandpiper	2	NA	NA			2
Least Sandpiper	2	NA	NA			2
Lesser Yellowlegs	2	NA	NA			2
Spotted Sandpiper	1	NA	NA	1		2
Upland Sandpiper	1	NA	NA	1		2
Hudsonian Godwit	1	NA	NA	1		2
Western Sandpiper	1	NA	NA		1	2
Greater Yellowlegs	1	NA	NA			1
Buff-breasted Sandpiper	1	NA	NA			1
Pacific Golden-Plover	1	NA	NA			1
Dunlin	0	NA	NA		1	1
Long-billed Dowitcher	0	NA	NA		1	1
Red Knot	0	NA	NA	1		1
Unidentified Shorebird	0	NA	NA	1		1

Table 4. Continued.

Group/species	Number of the plots where species: Detected during 10-min count	Detected during 5-min count	Tallied during 10-min count	Detected between points only	Detected off transect only	Detected
Potential predators						
Common Raven	31	NA	NA	1	6	38
Long-tailed Jaeger	29	NA	NA	1	2	32
Golden Eagle	10	NA	NA	1	8	19
Northern Harrier	11	NA	NA	3	2	16
Rough-legged Hawk	10	NA	NA	3		13
Merlin	2	NA	NA	5	5	12
Parasitic Jaeger	8	NA	NA	1	2	11
Short-eared Owl	6	NA	NA	2	1	9
Gyrfalcon	2	NA	NA	1	3	6
Peregrine Falcon	3	NA	NA			3
Gray Jay	1	NA	NA		2	3
Pomarine Jaeger	1	NA	NA			1
Unidentified Raptor	1	NA	NA			1
Unidentified Falcon	1	NA	NA			1
Red-tailed Hawk	0	NA	NA		1	1

[1]Methods of detection: Detected during 10-min count = detailed data collected for any individuals detected during 10-min count; Detected between points only = occurred along transect routes but not detected during counts; Detected off transect only = occurred on plot but not detected along transect routes or during counts; and Detected = # of plots where species occurred based on all of the above methods.

[2]Data not available; species not monitored by this method.

Table 5. Number of plots (n = 20 in 2001, n = 22 in 2002) on which each passerine species was detected[1] on the the Arctic Network surveys.

	Number of plots where species were:					
Species	Detected during 10-min count	Detected during 5-min count	Tallied during 10-min count	Detected between points only	Detected off transect only	Detected
Redpoll species	NA[2]	38	41			42
Savannah Sparrow	NA	36	36		2	38
American Tree Sparrow	NA	35	35		2	37
White-crowned Sparrow	NA	32	35	1		36
American Pipit	NA	29	30		3	34
Horned Lark	NA	28	30	2		34
American Robin	NA	31	33			33
Lapland Longspur	NA	23	23	2	3	28
Gray-cheeked Thrush	NA	21	24	1	2	28
Golden-crowned Sparrow	NA	27	25			27
Fox Sparrow	NA	26	22	1		27
Bluethroat	NA	22	23		3	26
Wilson's Warbler	NA	16	17	2	2	22
Northern Wheatear	NA	15	15	1	4	21
Orange-crowned Warbler	NA	10	13	1	3	17
Yellow Warbler	NA	8	6	2	3	13
Common Redpoll	NA	5	6		5	12
Say's Phoebe	NA	2	9	2	2	11
Yellow Wagtail	NA	8	7			10
Gray-crowned Rosy-Finch	NA	4	2	3	1	9
Varied Thrush	NA	7	7	1		8
Snow Bunting	NA	2	4	2	3	8
Hoary Redpoll	NA	5	3		1	6
Yellow-rumped Warbler	NA	3	4			6
Ruby-crowned Kinglet	NA	3	3			4
Dark-eyed Junco	NA	0	1	2	1	4
Bank Swallow	NA	1	3			3
Northern Shrike	NA	1	1	1		2
Boreal Chickadee	NA	1	1		1	2
Pine Grosbeak	NA	0	2			2
Arctic Warbler	NA	1	1			1
Swainson's Thrush	NA	1	1			1
Rusty Blackbird	NA	1	0			1
Northern Flicker	NA	1	0			1
Unidentified Chickadee	NA	0	1			1
Hermit Thrush	NA	0	0		1	1
Tree Swallow	NA	0	0		1	1
Unidentified Swallow	NA	0	0		1	1
Unidentified Woodpecker	NA	0	0	1		1

[1]Methods of detection: Detected during 5-min count = detailed data for individuals detected during 5-min count; Tallied during 10-min shorebird/predator count = presence/absence noted during 10-min count; Detected between points only = occurred along transect routes but not detected during counts; Detected off transect only = occurred on plot but not detected along transect routes or during counts; and Detected = # of plots where species occurred based on all of the above methods.

[2]Data not available; species not monitored by this method.

Table 6. Number of plots (n = 20 in 2001, n = 22 in 2002) on which species of waterfowl, gull, tern, upland game, and crane were detected[1] on the the Arctic Network surveys.

	Number of plots where species:					
Group/species	Detected during 10-min count	Detected during 5-min count	Tallied during 10-min count	Detected between points only	Detected off transect only	Detected
Waterfowl						
Northern Pintail	NA[2]	5[3]	7	3	2	14
Long-tailed Duck	NA	8	10	2		12
Canada Goose	NA	6	6	3	2	11
Greater Scaup	NA	6	6	2	2	10
Greater White-fronted Goose	NA	3	4	2	3	10
Tundra Swan	NA	2	1	2		4
Green-winged Teal	NA	1	2	1	1	4
Pacific Loon	NA	2	3			3
Brant	NA	0	1		2	3
Common Merganser	NA	0	1	2		3
Red-breasted Merganser	NA	1	2			2
American Wigeon	NA	0	0	1	1	2
Mallard	NA	0	1	1		2
White-winged Scoter	NA	1	1			1
Surf Scoter	NA	1	1			1
Common Loon	NA	1	1			1
Red-throated Loon	NA	1	1			1
Black Scoter	NA	1	0			1
Yellow-billed Loon	NA	0	1			1
Bufflehead	NA	0	0	1		1
Snow Goose	NA	0	0	1		1
Unidentified scoter	NA	0	0	1		1
Northern Shoveler	NA	0	0		1	1
Gulls and Terns						
Mew Gull	9[4]	NA[4]	NA	6	1	18
Glaucous Gull	6	NA	NA	6	1	14
Arctic Tern	NA	4	4	2	1	8
Upland Game and Cranes						
Rock Ptarmigan	NA	20[5]	24	1	3	30
Willow Ptarmigan	NA	13[5]	21	1	4	26
Spruce Grouse	NA	0	0	1		1
Sandhill Crane	NA	NA	1	3	1	5

[1]Methods of detection: Detected during 5-min count = detailed data for individuals of passerine species detected during 5-min count; Tallied during 10-min shorebird/predator count = presence/absence noted during 10-min count; Detected between points only = occurred along transect routes but not detected during counts; Detected off transect only = occurred on plot but not detected along transect routes or during counts; and Detected = # of plots where species occurred based on all of the above methods.

[2]Data not available; species not monitored by this method.

[3]Waterfowl not monitored during 5-min counts in 2001, thus n = 22 plots for 5-min counts (2002 only).

[4]Gulls and terns not monitored during counts in 2001, thus n = 22 plots for 5- and 10-min counts (2002 only).

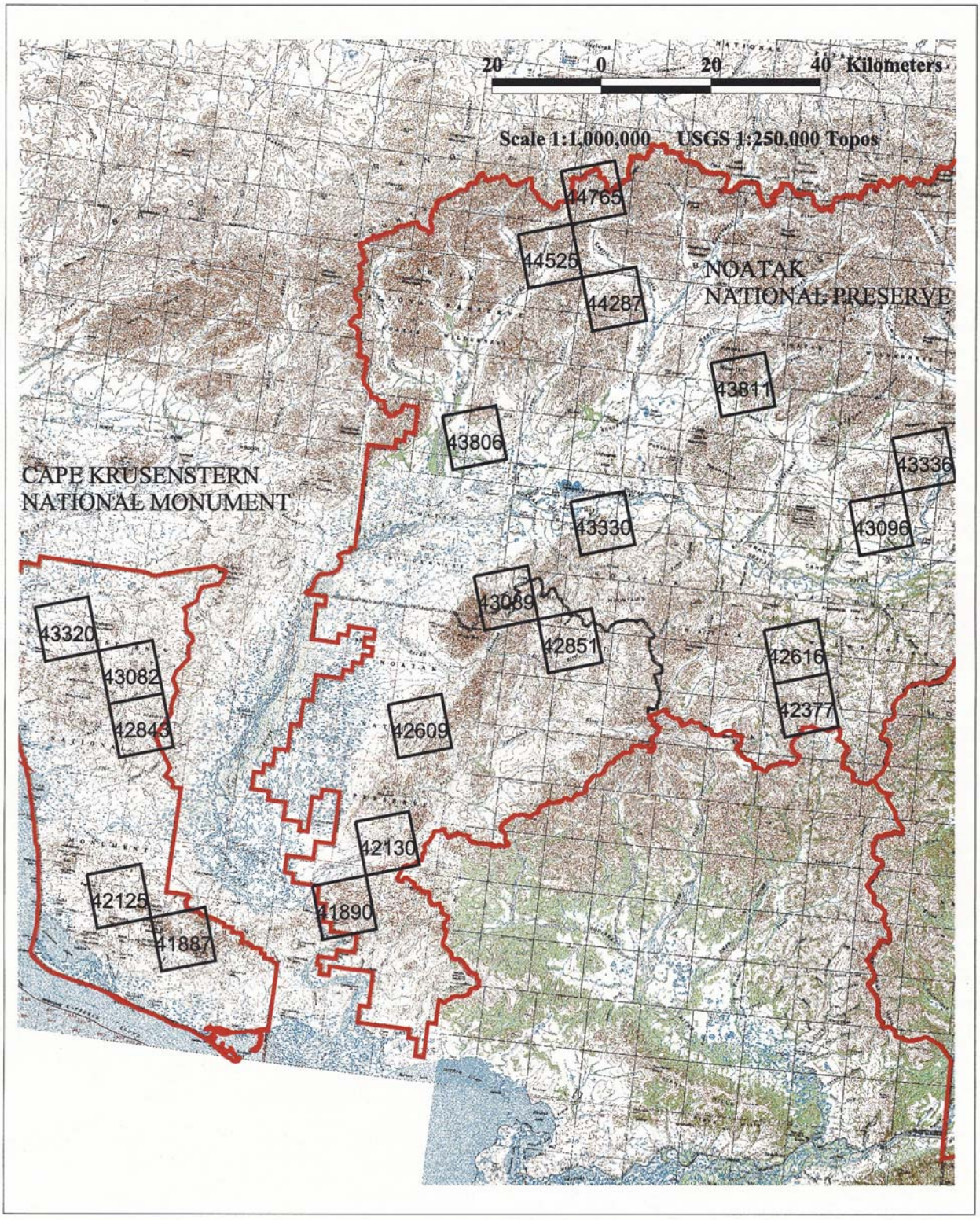
[5]Based on 13 plots in 2001 and 22 plots in 2002 where ptarmigan monitored during 5-min counts.

Table 7. Number of individuals (No.) and average occurrence per point (AO; number of individuals/total number of points surveyed) of shorebirds and potential shorebird predators detected during 10-min counts at Cape Krusenstern National Monument (*n* = 120 points), Kobuk Valley National Park (*n* = 197 points), and Noatak National Preserve (*n* = 688 points), 2001 and 2002.

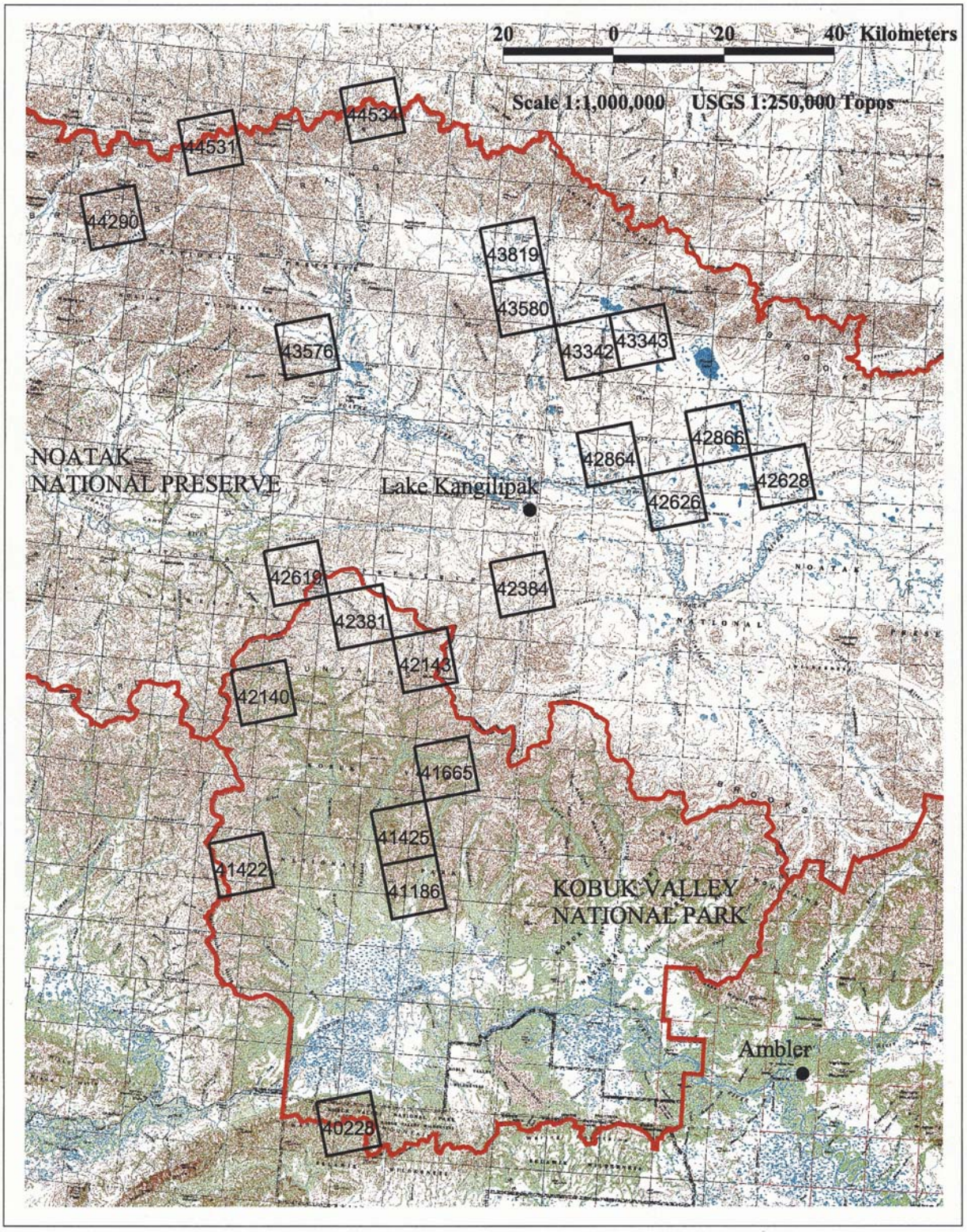
	Cape Krusenstern		Kobuk Valley		Noatak	
Group/species	No.	AO	No.	AO	No.	AO
Shorebirds						
American Golden-Plover	79	0.658	4	0.020	107	0.156
Pacific Golden-Plover					1	0.001
Semipalmated Plover					6	0.009
Greater Yellowlegs					1	0.001
Lesser Yellowlegs					3	0.004
Spotted Sandpiper			1	0.005		
Wandering Tattler			2	0.010	25	0.036
Upland Sandpiper					2	0.003
Whimbrel	143	1.192			100	0.145
Hudsonian Godwit					1	0.001
Bar-tailed Godwit	37	0.308				
Surfbird			7	0.036	11	0.016
Semipalmated Sandpiper	12	0.100			6	0.009
Western Sandpiper	9	0.075				
Least Sandpiper					2	0.003
Baird's Sandpiper			3	0.015	16	0.023
Pectoral Sandpiper	5	0.042				
Buff-breasted Sandpiper	9	0.075				
Wilson's Snipe	87	0.725	24	0.122	101	0.147
Red-necked Phalarope					6	0.009
Unidentified shorebird	6	0.050			5	0.007
Total shorebirds	387		41		393	
Potential predators						
Northern Harrier	9	0.075	2	0.010	9	0.013
Rough-legged Hawk	8	0.067			6	0.009
Golden Eagle	1	0.008	3	0.015	10	0.015
Merlin			1	0.005	1	0.001
Gyrfalcon					2	0.003
Peregrine Falcon	2	0.017	1	0.005		
Unidentified eagle					1	0.001
Unidentified raptor	3	0.025			1	0.001
Unidentified falcon			1	0.005		
Pomarine Jaeger					4	0.006
Parasitic Jaeger	7	0.058			20	0.029
Long-tailed Jaeger	198	1.650	4	0.020	168	0.244
Unidentified jaeger					4	0.006
Mew Gull			6	0.030	31	0.045
Glaucous Gull					25	0.036
Unidentified gull			1	0.005		
Short-eared Owl	4	0.033			2	0.003
Gray Jay			1	0.005		
Common Raven	57	0.475	20	0.102	49	0.071
Total predators	289		40		333	

Table 8. Number of individuals (No.) and average occurrence per point (AO; number of individuals/total number of points surveyed) of passerines and ptarmigan detected during 5-min counts at Cape Krusenstern National Monument (n = 119 points), Kobuk Valley National Park (n = 197 points), and Noatak National Preserve (n = 688 points for passerines, n = 529 points for ptarmigan), 2001 and 2002.

	Cape Krusenstern		Kobuk Valley		Noatak	
Group/species	No.	AO	No.	AO	No.	AO
Passerines						
Northern Flicker			1	0.005		
Say's Phoebe	1	0.008			2	0.003
Northern Shrike					1	0.001
Horned Lark	7	0.059	19	0.096	48	0.070
Bank Swallow					5	0.007
Boreal Chickadee			1	0.005		
Ruby-crowned Kinglet			6	0.030		
Arctic Warbler					2	0.003
Bluethroat	30	0.252	4	0.020	49	0.071
Northern Wheatear	1	0.008	9	0.046	17	0.025
Swainson's Thrush			1	0.005		
Gray-cheeked Thrush	7	0.059	23	0.117	34	0.049
American Robin			76	0.386	128	0.186
Varied Thrush			59	0.299	5	0.007
Yellow Wagtail	2	0.017	1	0.005	15	0.022
American Pipit	11	0.092	43	0.218	99	0.144
Orange-crowned Warbler	3	0.025	9	0.046	13	0.019
Yellow Warbler			2	0.010	12	0.017
Yellow-rumped Warbler			12	0.061		
Northern Waterthrush			2	0.010		
Wilson's Warbler			21	0.107	26	0.038
American Tree Sparrow	31	0.261	45	0.228	319	0.464
Savannah Sparrow	60	0.504	34	0.173	407	0.592
Fox Sparrow	3	0.025	64	0.325	54	0.078
White-crowned Sparrow	10	0.084	39	0.198	172	0.250
Golden-crowned Sparrow			107	0.543	154	0.224
Lapland Longspur	136	1.143	10	0.051	179	0.260
Snow Bunting					14	0.020
Rusty Blackbird			1	0.005		
Gray-crowned Rosy Finch	1	0.008	3	0.015	1	0.001
Redpoll (both species)	15	0.126	62	0.315	184	0.267
Unidentified sparrow			18	0.091	10	0.015
Unidentified passerine	12	0.101	11	0.056	7	0.010
Total passerines	330		683		1957	
Ptarmigan						
Willow Ptarmigan	234	1.966	1	0.005	25	0.047
Rock Ptarmigan	70	0.588	9	0.046	51	0.096
Unidentified ptarmigan	4	0.034			2	0.004
Total ptarmigan	308		10		78	



Appendix 1. Location of sample plots in 2001 at Cape Krusenstern National Monument and Noatak National Preserve.



Appendix 2. Location of sample plots in 2002 at Noatak National Preserve and Kobuk Valley National Park.